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Velocity Explains the Links between Personality States and Affect

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Abstract

The present research examined whether perceived rate of progress toward a goal (velocity) mediated the relationships between personality states and affective states. Drawing from control theories of self-regulation, we hypothesized (i) that increased velocity would mediate the association between state extraversion and state positive affect, and (ii) that decreased velocity would mediate the association between state neuroticism and state negative affect. We tested these hypotheses in 2 experience sampling methodology studies that each spanned 2 weeks. Multilevel modeling analyses showed support for each of the bivariate links in our model, and multilevel path analyses supported our mediation hypotheses. We discuss implications for understanding the relations between personality states and affective states, control theories of self-regulation, and goal striving.

Keywords

Velocity; Personality states; Affect; Extraversion; Neuroticism

Imagine freshman college student “Dash.” During the first week of his first semester, Dash decides to go to a party near campus. At the party, Dash wants to achieve a number of positive outcomes as well as avoid negative outcomes. He wants to meet people and get to know them, make friends, and maybe even find a romantic partner for the night; he wants to avoid being criticized and does not want to appear foolish. Dash acts in a variety of different ways over the course of the evening in order to accomplish these goals. His behavior may be characterized as talkative and bold when pontificating about lacrosse to his new friends, whereas his behavior is silent and timid when the topic of conversation turns to politics. His behavior is insecure and high-strung around a group of attractive men and women, but he is secure and relaxed when his friends ask him about his interactions with the attractive group

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of people. In other words, Dash's behavioral states varied on state extraversion and state neuroticism. In turn, these different ways of behaving were associated with Dash's cognitive perceptions of how he was progressing toward his goals. At times that he acted more extraverted (as compared with more introverted), he perceived that he was moving towards his approach goals at a relatively high rate (i.e., *velocity*). In turn, higher velocity was associated with feelings of positive affect in Dash. In contrast, when he acted more neurotic (as compared with more emotionally stable), he perceived himself as moving toward his goals at a relatively low velocity. In turn, lower velocity was related to Dash feeling negative affect.

This example illustrates the topic of this paper: to examine the relations between goals, personality states, perceived rate of progress toward goals (i.e., *velocity*), and affective states. Specifically, the purpose of this paper is to examine whether perceived velocity toward goals explains the links between personality states and affective states. We test whether velocity mediates (i) the association between state extraversion and state positive affect and (ii) the association between state neuroticism and state negative affect. Our predictions are that: (i) state extraversion will lead to higher velocity, and higher velocity will lead to positive affective states; and (ii) state neuroticism will lead to lower perceived velocity, and lower velocity will lead to negative affective states. Our hypotheses and the given example were based primarily on perspectives on control theories of self-regulation (e.g., Carver & Scheier, 1990 e.g., Carver & Scheier, 1998), so named because they draw heavily upon the principles of feedback control of behavior (Powers, 1973). We next detail how we derived our hypotheses from this perspective.

A Self-Regulation Perspective on Behavior, Goals, Velocity and Affect

Control theories of self-regulation emphasize feedback loops to explain the relations between goal-directed behaviors, velocity, and affect (for reviews, see Carver & Scheier, 2009; 2013). The first feedback loop monitors discrepancies between one's current condition and one's desired condition or goal, where the person's goal serves as a reference value. The effect of this feedback loop is to modify behavior until one's present condition reaches the goal; that is, the purpose of this feedback loop is to produce goal achievement. The second feedback loop monitors the rate or *velocity* at which one's behavior is reducing the discrepancy between one's current condition and one's goal. From this perspective, affective states are produced by discrepancies between one's current velocity and one's intended velocity, which serves as a reference value. If sensed velocity is higher than the reference value, positive emotions are produced (i.e., things are going well). If velocity is lower than the reference value, negative emotions are produced (i.e., things are going poorly). If sensed velocity is equal to the reference value, no affective reactions occur.

The variables of interest in this paper fit within this framework as follows. State extraversion and state neuroticism represent the psychological (i.e., affective, *behavioral*, cognitive) content of each respective trait except occurring over a relatively short timeframe (Fleeson, 2001, Fleeson & Gallagher, 2009; Fleeson & Jayawickreme, 2015). These personality states reflect the quality and kinds of affects, behaviors, and cognitions that a person engages in over a specified time span. We hypothesized that state extraversion should relate to increased

velocity and that neuroticism should relate to decreased velocity. Going back to our example of the freshman college student, state extraversion resulted in a perceived rate of progress toward one's goals that was higher than the reference velocity, whereas state neuroticism resulted in a perceived rate of progress that was lower than the reference velocity. In turn, positive affect was produced from extraverted states via increased velocity, and negative affect was produced from neurotic states via decreased velocity. Thus, velocity acted as a mediator between personality states and affective states. We next focus on each of the bivariate links between the variables included in this example.

Personality states and affective states

Before reviewing the evidence linking personality states and affective states, it is important to clarify potential confusion regarding this type of research. Specifically, confusion may arise because personality states, by definition (and similar to their corresponding traits), include affective content (Fleeson & Jayawickreme, 2015). Thus, there is concern as to whether the "links" between personality states and affective states are due simply to affective content overlap. To address this possibility, the research reviewed below (and the research presented in this article) employed measures of personality states that did not include the same content as the affective measures.

An early study showed that momentary extraverted states were related to positive affect states (Schutte, Malouff, Segrera, Wolf, & Rodgers, 2003), and multiple studies employing experience sampling methodology (ESM) have shown that increases in state extraversion are related to increases in state positive affect in naturalistic settings (Bleidorn & Denissen, 2015; Fleeson, Malanos, & Achille, 2002; Heller, Komar, & Lee, 2007; Wilt, Noftle, Spain, & Fleeson, 2012). The relation between extraverted states and positive affect in ESM studies has also been observed in non-Western cultures, including Venezuela, the Philippines, China, and Japan (Ching et al., 2014). Furthermore, experiments in which people were randomly assigned to act extraverted or introverted have revealed a causal association leading from state extraversion to state positive affect (McNiel & Fleeson, 2006; McNiel, Lowman, & Fleeson, 2010; Smillie, Wilt, Kabbani, Garrat, & Revelle, 2015; Zelenski et al., 2013). Similarly, there are a number of studies linking state neuroticism to state negative affect. This association has been observed at the level of momentary states (Schutte et al., 2003), in ESM studies in naturalistic settings (Heller et al., 2007) across cultures (Ching et al., 2014), and in experimental settings in which participants were randomly assigned to act neurotic or emotionally stable (McNiel & Fleeson, 2006). In sum, there is good evidence that state extraversion leads to state positive affect, and that state neuroticism leads to state negative affect.

Velocity and affect

Evidence linking velocity to affect has also been accumulating steadily. It may reduce confusion to remind the reader here that velocity in all studies below refers broadly to the rate of progress toward a specified goal rather than the rate at which tasks are completed.

The first studies investigating this phenomenon (Hsee & Abelson, 1991) had participants indicate their preference among hypothetical scenarios based on the degree of satisfaction

that they would obtain from each scenario. For scenarios involving positive outcomes (e.g., improving class standing), participants preferred scenarios in which they improved at a high velocity compared to a low velocity, and they preferred small, fast improvements to large, slow improvements. For example, scenarios in which class rank improved rapidly were favored over those in which class rank improved more slowly, and scenarios in which class rank improved quickly but to a small degree were favored over those in which class rank improved slowly and to a large degree. For negative outcomes (e.g., decreasing salary), participants preferred scenarios that involved slow decreases to fast decreases and they preferred large, slow decreases to small, fast decreases.

A conceptual replication of these findings (Lawrence, Carver, & Scheier, 2002) involved an experiment in which participants received different success feedback rates on an ambiguous task. For example, a task involved answering whether a word from a foreign language (likely to be unfamiliar to participants) conveyed the same meaning as an English word. Results showed that, given equal success (number of "correct" trials) over time, participants reported increases in positive mood when their *rate* of success feedback increased over time and decreases in mood when their *rate* of success feedback decreased over time.

Chang, Johnson, and Lord (2010) presented a field study showing that participants preferred higher perceived velocity toward desired job characteristics (e.g., scenarios in which they perceived rapid progress toward their professional goals) was related to higher satisfaction with those characteristics, as well as an experimental study showing that higher actual velocity on task performance (e.g., high rate of success feedback on an ambiguous task) contributed to higher satisfaction with one's task performance. Finally, Elicker et al. (2010) presented a longitudinal study of students showing that higher perceived velocity toward a desired class goal (e.g., perception that one's performance on exams was increasing at a rapid rate) was related to satisfaction with performance in the class. Taken together, these studies suggest that people much prefer experiencing high velocity toward goals as compared with low velocity.

Personality states and velocity

Although no empirical studies have investigated the links between personality states and velocity, there is good reason to expect that state extraversion should lead to higher perceived velocity and that state neuroticism should lead to lower perceived velocity. Indeed, as control theories of self-regulation propose that behaviors are connected to affect through velocity (Carver, 2015), it follows logically from this framework that higher velocity is at least in part responsible for the association between state extraversion and state positive affect, and that lower velocity at least in part explains the association between state neuroticism and state negative affect. Therefore, our studies are a critical test of this tenet of control theories of self-regulation.

But how do personality states lead to changes in velocity toward goals? Emerging theories suggest that personality states are often manifested in order to meet goals (e.g., DeYoung, 2015; Fleeson & Jayawickerme, 2015), and empirical evidence has shown that personality states are predictable from one's goals (Bleidorn, 2009; Heller et al., 2007; McCabe & Fleeson, 2012). We hypothesize that state extraversion, as compared with state introversion,

might facilitate more rapid progress toward goal achievement on average. We also hypothesize that state neuroticism, as compared with state emotional stability, might slow one's rate of progress toward goals on average. These hypotheses are based on studies showing that the most goals are about either getting along or getting ahead, or communion and agency (Chulef, Read, & Walsh, 2001; Trapnell & Paulhus, 2012). Following McNiel and Fleeson (2006), we believe that the content of extraverted states (e.g., talkative, gregarious, bold, assertive) seems particularly well suited to accomplishing these goals; in contrast, neurotic states (e.g., touchy, volatile, insecure, high-strung) do not seem conducive to good relations with others or achieving influence over others.

Approach/avoidance goals and personality states

Going back to our example again, we noted that Dash wanted to both attain positive outcomes (e.g., making friends) and sidestep negative outcomes (e.g., avoiding criticism). Goals concerned with achieving positive outcomes are more formally termed approach goals, whereas those concerned with averting negative outcomes are termed avoidance goals (Austin & Vancouver, 1996; Elliot, 2006). In the example, approach goals were related to extraverted states, whereas the avoidance goals were related to neurotic states. This characterization is in line with results from an experience sampling study that examined the links among these variables at the state level (Heller et al., 2007). Further, more recent research has suggested that personality states are enacted in the service of meeting one's goals (McCabe & Fleeson, 2012; 2016). Thus, we sought to extend our mediation model to include the approach/avoidance goal construct as an antecedent to personality states. As extraversion and neuroticism are considered parts of broader neurobiological approach and avoidance systems, respectively (Carver, Sutton, & Scheier, 2000; Elliot & Thrash, 2002) we predicted that approach goals would be related to extraverted states, and we predicted that avoidance goals would be related to neurotic states.

Overview of Research

The impetus for this research was to obtain a better understanding of the dynamic relations between personality states, perceived rate of progress toward goals (velocity), and affect. Control theories of self-regulation provided an elegant conceptual framework for considering the relations between these constructs. In order to test hypotheses derived from this framework, we conducted 2 ESM studies in which we obtained multiple ratings of state extraversion, state neuroticism, velocity, positive affect, and negative affect over time. We also obtained ratings of goal importance and proximity to current goals in order to examine whether velocity toward goals was uniquely related to affect when controlling for these variables.

Study 1 involved undergraduates as well as community adults, and Study 2 involved only undergraduate participants. Additionally, in Study 2, we obtained ratings of whether participants were trying to pursue a positive outcome (approach goal) or avoid a negative outcome (avoidance goal). This allowed us to extend our mediation models to include the approach-avoidance goal construct. As the methods, analyses, and results, were highly similar across studies, we present these sections together for the purposes of brevity and

clarity. We indicate in the text where the methods, analyses, and/or results diverged across the two studies.

Methods

Participants

In Study 1, participants were 49 people (36 female) who were recruited from advertisements on a paid subject pool website and on websites listing part-time job opportunities in the greater Chicago, IL area. Nine participants were excluded from analyses due to the following reasons: completing fewer than 5 ESM reports, showing no variability in responses over time, or submitting a large number of incomplete reports. Thus, a total of 40 people (29 female) were included in analyses: 21 were university students and 19 were community adults, with a mean age of 23.50 ($SD = 5.61$).

In Study 2, participants were 48 Northwestern University undergraduates (40 female) who were recruited from advertisements on a paid subject pool website, fliers posted on campus, and e-mails to class rosters. Eight participants were excluded from analyses for the reasons listed above, leaving a total of 40 participants (33 female) who were included in analyses, with a mean age of 20.60 ($SD = 2.22$).

Procedure

In each study, participants filled out an initial, online questionnaire as part of a larger study and then attended a training session on the ESM protocol involving text messaging. At the session, participants received a 6.4 cm × 8.9 cm picture-frame key chain, inside of which was a double-sided sheet of paper containing items assessing personality states, velocity toward goals, and affect. Cards also included additional items that were not relevant to this particular study: 50 items were presented on the card in Study 1, and 44 items were presented on the card in Study 2.[1] Before beginning the study, each participant had to be able to send a correctly completed practice response.

In each study, six times per day (9 A.M., 12 P.M., 3 P.M., 6 P.M., 9 P.M., 12 A.M.) for two weeks, participants received a text message (automatically sent from a secure-email account using Applescript) requesting that they respond to the items on their key chain. Participants replied by sending a text message containing a string of numbers, one corresponding to each adjective printed on the key chain. Participants were compensated (up to $50 in Study 1 and $60 in Study 2) based on their number of complete text message responses. For Study 1, the mean number of responses was 55.7 ($SD = 23.7$, 66% rate of completion) and the median number of responses was 60 ($MAD = 26.7$), which was similar to traditional ESM studies (Conner, Barrett, Tugade, & Tennen, 2007). Study 2 showed slightly higher response rates: the mean number of responses was 69.7 ($SD = 24.4$, 83% rate of completion) and the median number of responses was 74.5 ($MAD = 17.1$)

[1]Data from these studies have been published previously (Wilt, Funkhouser, &Revelle, 2011). The analyses did not overlap with the current studies.

Importantly, the sample sizes in these studies — 40 participants providing a total of 2,226 individual reports in Study 1, and 40 participants providing a total of 2,787 reports in Study 2 — provided adequate power to detect moderate effect sizes for within-person effects using multilevel statistical approaches (Kreft & deLeeuw, 1998; Scherbaum & Ferreter, 2009), which were the primary analytic strategies employed in this study (described in the Analyses section). Additionally, these sample sizes are adequate for producing accurate estimates of within-person effect sizes in multilevel approaches (McNiesh & Stapleton, in press). In these studies, we were focused only on the associations of constructs at the within-person level. Although it is possible to examine between-person effects, our hypotheses only concerned within-person effects, and the number of participants in each study (40 in each study) resulted in low power to detect between-person effects.

Materials

In order to increase ease of reference, the items used to assess the variables described below are also shown in Table 1.

Personality states—To assess extraverted and neurotic personality states, participants responded to prompts asking them to rate their behavior "over the past 30 minutes" on adjectives selected from Goldberg's (1990) adjective trait descriptors. Responses were made on a scales ranging from 1 (not at all) to 6 (very).

In Study 1, state extraversion was assessed with the adjectives, "bold", "quiet" (reverse-scored), and "talkative." In Study 2, state extraversion was assessed with the adjectives, "assertive", "withdrawn" (reverse-scored), and "unrestrained." In Study 1, state neuroticism was assessed with the adjectives, "touchy", "temperamental", and "insecure." In Study 2, state neuroticism was assessed with the adjectives, "steady" (reverse-scored), "anxious", and "emotional."

Goal characteristics—In each study, participants first indicated which of 6, self-selected goals (reported on the initial questionnaire) that they were most trying to achieve over the past 30 minutes. Then, participants rated the goals with regard to velocity, importance, proximity, and (in Study 2 only) approach/avoidance.

In Study 1, to assess velocity toward goals, participants indicated how accurate the following statements were on a scale from 1 (not at all) to 6 (very): "I was moving quickly toward the goal", "My progress toward the goal was slow" (reverse-scored), and "I was doing better than I expected at the goal." In Study 2, participants responded to the single item, "What was your rate of goal achievement?" on a scale from 1 (slower than expected) to 6 (faster than expected).

In Study 1, to assess goal importance, participants indicated how accurate the following statements were on a scale from 1 (not at all) to 6 (very): "The goal was important to me" and "The goal did not matter much to me" (reverse-scored). In Study 2, participants responded to the single item, "How important was the goal?" on a scale from 1 (slower than expected) to 6 (faster than expected).

In Study 1, to assess goal proximity, participants indicated how accurate the following statements were on a scale from 1 (not at all) to 6 (very): "I almost achieved (or achieved) the goal" and "I was very far away from the goal" (reverse-scored). In Study 2, participants responded to the single item, "How close were you to achieving the goal?" on a scale from 1 (far away or gave up) to 6 (extremely close/achieved).

We assessed whether the selected goal was an approach or avoidance goal in Study 2 only. Participants were asked to respond to the question, "Would the goal be best described as pursuing a positive outcome or avoiding a negative outcome?" Participants responded with "1" for a positive outcome (indicating an approach goal) and "2" for a negative outcome (indicating an avoidance goal).

Affect—To assess positive and negative affect, participants responded to prompts asking them to rate their affect "right now" on a scale from 1 (not at all) to 6 (very). In Study 1, positive affect was assessed with the adjectives "alert", "happy", "attentive", and "strong." In Study 2, positive affect was assessed with the adjectives "happy", "cheerful", and "pleased." In Study 1, negative affect was assessed with the adjectives "irritable", "intense", and "upset." In Study 2, negative affect was assessed with the adjectives "grouchy", "irritable", and "gloomy."

Data Analyses

We first computed descriptive statistics using the statistical program *R* (R Development Core Team, 2015) and *MPlus version 7.4* (Muthén & Muthén, 2012). These statistics were computed using the base functions in R, the *psych* package (Revelle, 2015), and the *multilevel* package (Bliese, 2013). These statistics included the average individual's mean, the within-person standard deviation, and the within-person *alpha* of states (for multi-item measures) as calculated from the average within-person correlations between items in each measure. Within-person ω statistics, which represent the average individual's reliability of within-person change over time (Lane & Shrout, 2010), were also calculated based on using the multilevel confirmatory factor analysis approach described in Geldhof, Preacher, and Zyphur (2014). The ω statistic was calculated only for scales with 3 or more items as recommended by Shrout and Lane (2012). Finally, we calculated *1-ICC1*, which indicates the percentage of total variation in states that was due to within-person variation (Bliese, 2006; Shrout & Fleiss, 1979).

Then, as the data in these studies had a multilevel structure, with text-messaging reports (level 1) nested in persons (level 2), we employed multilevel modeling (MLM) procedures to examine the bivariate associations among variables that were specified by our mediation models. MLM permits the analysis of interdependent data without violating the assumptions of ordinary least squares (OLS) regression, and, compared with OLS regression, MLM provides more accurate standard errors and more reliable tests of effects (Bryk & Raudenbush, 1992). We conducted MLMs using the package *nlme* (Pinheiro, Bates, DebRoy, & Sarkar, 2013) in R. Predictor variables were mean centered around each individual's mean. As such, the associations between variables in MLMs (estimated by unstandardized *b* coefficients) indicated the degree to which the dependent variable was

predicted to change for the typical individual given a 1-point change in the independent variable. All within-subjects effects were entered as random effects (Nezlek, 2012).

Finally, we constructed mediation models using a MLM path analytic approach (Muthén & Asparouhov, 2011; Preacher, Zhang, & Zyphur, 2011; Preacher, Zyphur, & Zhang, 2010). The models all had a 1-1-1 MLM structure, meaning that all variables in the model were assessed at level 1. In a multilevel path modeling approach, the relationships between variables are modeled simultaneously to arrive at an estimation of indirect effects. The direct and indirect effects in MLM path models were estimated by unstandardized *b* coefficients. The multilevel path analyses were conducted in *MPlus version 7.4* (Muthén & Muthén, 2012).

Results and Discussion

Descriptive Statistics

Table 2 shows descriptive statistics for Studies 1 and 2. In both studies, the typical participant showed moderate levels of state extraversion, goal characteristics, and positive affect, whereas the typical participant showed relatively low levels of state neuroticism and state negative affect. In Study 2, the typical participant reported pursuing a relatively high proportion of approach goals as compared with avoidance goals. Across variables, the within-person *SD*s were high, and the 1-*ICC1*s showed that a large proportion of the total variance was due to within-person variation. These results were important because we were interested in examining within-person covariation with MLM analyses. The within-person α and ω statistics were generally acceptable given the low number of items in each composite scale. That is, the relatively low reliabilities observed for some variables were more reflective of the low number of items per scale rather than the items having low correlations with each other; for instance, the lowest average-item correlation was for state neuroticism in Study 2 (average within-person $r = .18$).

Multilevel Modeling: Bivariate Models

Our hypothesized mediation model linking state extraversion to state positive affect via increased velocity specified the following bivariate links: state extraversion to state positive affect; state extraversion to velocity; and velocity to state positive affect. Likewise, the mediation model linking state neuroticism to state negative affect via decreased velocity specified the following bivariate links: state neuroticism to state negative affect; state neuroticism to velocity; and velocity to state negative affect. Further, the extension of our model to include approach-avoidance goals in Study 2 links approach goals to state extraversion and avoidance goals to state neuroticism. Prior to conducting MLM path analyses testing for mediation, we first present the bivariate MLM results in order to examine the plausibility of our mediation models. We examine each of the bivariate links below.

Table 3 presents the results of the bivariate MLMs. It is clear that each bivariate link in the mediation models was supported by these results.[2] In both studies, state extraversion was related to higher levels of state positive affect; state extraversion was related to higher

perceived velocity; and higher perceived velocity was related to state positive affect. Similarly, state neuroticism was related to higher levels of state negative affect; state neuroticism was related to lower perceived velocity; and lower perceived velocity was related to state negative affect.[3] Furthermore, holding an approach goal was related to higher levels of state extraversion, and holding an avoidance goal was related to higher levels of state neuroticism. Thus, our mediation models are plausible based on the MLM results. Additionally, the 95% confidence intervals for random effects (*SD*s) showed that each bivariate association among constructs varied across individuals. We next present more formal and stringent tests of mediation using multilevel path analyses.

Multilevel Path Analyses

In Study 1, we conducted one MLM path analysis specifying that velocity mediated the relationship between state extraversion and state positive affect, and we conducted another MLM path analyses specifying that velocity mediated the path between state neuroticism and state negative affect. In Study 2, we added to these models by predicting state extraversion and state neuroticism from the categorical approach/avoidance goals variable. For models including state extraversion and state positive affect, velocity was positively scored; for models including state neuroticism and state negative affect, velocity was negatively scored. This was done so that the sign of the coefficients relating velocity to other variables in the models would be positive, which increased the interpretability of the indirect effect and total effect in each model.

Figure 1 shows the direct effects of the path models relating state extraversion to state positive affect, and Figure 2 shows the direct effects for path models relating state neuroticism to state negative affect. Tables 4 and 5 display the full results of these models. Across all models, the direct effects were consistent with the results from the bivariate MLM analyses presented above and suggest that each of the links in our models were supported. The indirect effects were significant in each Study, which supported our mediation hypotheses. Velocity explained 12.5% of the total effect of state extraversion on positive affect in Study 1 and 14% of this effect in Study 2. Velocity explained 21.7% of the effect of state neuroticism on state negative affect in Study 1 and 27% of this effect in Study 2. In sum, the MLM path analyses revealed that state extraversion leads to state positive affect in part via increased velocity toward goals, and that state neuroticism leads to state negative

[2]We also conducted MLMs controlling for the within-person means as level 2predictors as recommended by Enders and Tofighi (2007). Although we did not have sufficient power to demonstrate reliable associations at level 2 in either study due to having only 40 level 2 units (participants) in each study (Scherbaum & Ferreter, 2009), it was still important to determine whether the level 1 effects remained when controlling for the level 2 effects. In all cases, results of the MLMs at level 1 were unaffected by including the within-person means (these results are available upon request).

[3]We conducted follow-up MLMs controlling for the effects of goal importance and goal proximity in both studies. State positive affect remained positively related to velocity in both studies (Study 1: $b = .12$, *95% CI* = .04 to .20, $p = .005$; Study 2: $b = .17$, *95% CI* = .11to .24, $p < .001$), and state negative affect remained negatively related to velocity in both studies (Study 1: $b = -.14$, *95% CI* = -.22 to -.06, $p < .001$; Study 2: $b = -.12$, *95% CI* = -.18 to -.06, $p < .001$). The relations between control variables and state affect were as follows. State positive affect was related to goal importance in Study 1 ($b = .06$, *95% CI* = .03 to .10, $p < .001$) but not Study 2 ($b = .00$, *95% CI* = -.03 to .02, $p = .74$). State positive affect was not related to goal proximity in Study 1 ($b = .00$, *95% CI* = -.04 to .05, $p = .86$) but was positively related to goal proximity in Study 2 ($b = .19$, *95% CI* = .15 to .23, $p < .001$). State negative affect was not related to goal importance in Study 1 ($b = .00$, *95% CI* = -.03 to .03, $p = .51$) but was positively related to goal importance in Study 2 ($b = .03$, *95% CI* = .00 to.05, $p = .03$). State negative affect was negatively related to goal proximity in both studies (Study 1: $b = -.07$, *95% CI* = -.11 to -.02, $p < .01$; Study 2: $b = -.16$, *95% CI* = -.19 to -.13, $p < .001$).

affect via decreased velocity toward goals. Additionally, approach goal states predicted extraverted states, whereas avoidance goal states predicted neurotic states.

General Discussion

In this paper, we developed mediation models relating personality states to affect via perceived velocity toward a goal. Across two ESM studies, we found support for the hypotheses (i) that state extraversion is linked to state positive affect via increased velocity toward a goal, and (ii) that state neuroticism is linked to state negative affect via decreased velocity toward a goal. Our confidence in these findings is bolstered by the use of different measurements of personality states, velocity toward goals, and affects across studies. Further, in Study 2, we extended these models by showing that holding an approach goal predicted extraverted states, whereas holding an avoidance goal predicted neurotic states. Below, we discuss the implications of these findings for research on within-person variations in personality states and affective states, control theories of self-regulation, and goal-striving more generally.

Dynamic Relations between Psychological States

Although the relationships between extraverted and positive affect states and the relationships between neurotic and negative affect states have been shown across multiple studies using varied methodologies (e.g., McNiel & Fleeson, 2006; Ching et al., 2014), there have been few explanations proposed for these associations. The results from the current studies suggest that velocity toward a goal is a general mechanism linking within-person variations in personality states to within-person variations in affective states. As such, state extraversion might be related to higher velocity because acting talkative, gregarious, bold, and assertive could help to move people more quickly toward common goals such as getting along with others (i.e., communion) and getting ahead of others (i.e., agency). In contrast, state neuroticism might be related to lower velocity because being touchy, volatile, insecure, and high-strung would not be conducive to these goals. Direct tests of these hypotheses, which were first proposed by McNiel and Fleeson (2006), await future research. Preferably, such studies would manipulate both personality states and goal content to determine which states facilitate to achieving different types of goals at faster rates.

To our knowledge, there have been no other studies investigating mediators of the relations between state neuroticism and state negative affect. However, one paper (Lischetzke, Pfeifer, Crayen, & Eid, 2012) showed that a positive mood regulation intention mediated the prospective association between extraverted states and positive affect, and another experimental study (Smillie et al., 2015) showed that perceived social contribution mediated the relation between state extraversion and state positive affect in a group discussion setting. Our findings regarding velocity fit well with these results. Positive mood regulation intentions may be conceptualized as goals, and it is reasonable to believe that extraverted states likely resulted in greater perceived velocity toward these desired states. The finding that perceived social contribution was a mediator of the state extraversion - state positive affect association raises the possibility that state extraversion was helping participants to

accomplish their social goals at a relatively high rate. Again, we leave it to future research to investigate these possibilities.

More broadly, our findings fit within emerging frameworks that conceptualize personality states as goal-directed manifestations of personality traits (Fleeson, 2015; Heller, Perunovic, & Reichman, 2009; Roberts & Jackson, 2008). In these perspectives, personality states are enacted for the purpose of meeting short-term demands of the environment. Our findings linking approach goal states to state extraversion and avoidance goal states to state neuroticism replicated Heller et al.'s (2007) findings and suggest that people prefer to enact different states in the service of different goal dimensions. Furthermore, state extraversion may help people to accomplish their goals more quickly, whereas state neuroticism might impede goal progress.

Taking an even more general outlook, our studies may be considered as being consistent with the idea that personality is best understood by looking at the relations between affects, behaviors, cognitions, and desires (or goals)—the ABCDs of personality (e.g., Wilt & Revelle, 2015)—over time and space. Our findings linked goal dimensions (approach-avoidance) to enacted behaviors (state extraversion and neuroticism), which in turn were related to cognitive perceptions (perceived velocity toward a goal) and finally to affective states (positive and negative affect). A unique component of this perspective is its emphasis on temporal dynamics (Revelle & Condon, 2015). This and other emerging approaches to personality dynamics (e.g., Fleeson, 2001; Sherman, Rauthmann, Brown, Serfass, & Bell, in press) are focused on variations in states over time, however, the research emerging from these approaches had not yet explicitly examined whether time plays an organizing role among in the covariation of states. In the current research, we specifically looked at how perceived rates of change in goal progress over time were crucial to mediating the relations between personality states and affect.

Self-regulation and Goal-Striving

The dynamic mediation models in our studies also provided critical tests of control theories of self-regulation (e.g., Carver & Scheier, 1990 e.g., Carver & Scheier, 1998). Whereas most previous studies examined velocity in relation to preferences (Hsee & Abelson, 1991) or satisfaction (Chang et al., 2010; Elicker et al., 2010), our results link velocity to positive and negative affect. This is important because control theories of self-regulation detail how perceived velocity toward a goal should be related to affective states (Carver & Scheier, 1990). Thus, our findings add to the surprisingly small body of research providing direct empirical support for the premise that one's rate of goal progress is involved in the production of affective states (Lawrence et al., 2002). Additionally, we found that velocity toward a goal was related to affect even when controlling for the importance of a goal and perceived proximity to goals, thus ruling out some potential third variable explanations.[3]

Our results might also be relevant to self-regulated goal-striving more generally. Particularly, certain behaviors were better suited on average for moving people toward their goals (state extraversion), whereas others were less effective (neuroticism). As state extraversion and state neuroticism can be self-regulated, as shown in experimental manipulations of those states (McNiel & Fleeson, 2006), people might benefit with regard to achieving their goals

by enacting more extraverted and fewer neurotic states. This suggestion, however, comes with the caveat that the longer-term effects of enacting personality states are not well known.

Furthermore, different states might be especially well-suited for achieving different goals. For example, state extraversion might better facilitate the achievement of social goals as compared to task-focused goals – indeed, one possible explanation for the average positive association between state extraversion and velocity that was observed in the current studies could be that people were frequently pursuing social goals, and that extraversion aided in these pursuits. Therefore, the relations between personality states and velocity might be moderated by the types of goals that are being pursued at a given time. Although state neuroticism showed an average negative association with velocity in the current studies, it might be the case that neurotic states are more conducive for achieving relatively less prevalent goals, such as up-regulating negative affect (e.g., Tamir & Ford, 2009), and that state neuroticism might relate to higher perceived velocity when trying to achieve such goals. The moderation of personality state – velocity associations may by goal types may be a particularly fruitful direction for future research.

Our results also replicated Heller et al. (2007) by showing that approach goals were related to extraverted states and that avoidance goals were related to neurotic states. These results speak to the capacity for structural dimensions of goals to energize and direct behavior (Austin & Vancouver, 1996), and they provide more support for the recent hypothesis that Big Five behaviors are enacted in the service of goal achievement (McCabe & Fleeson, 2012; 2016). The results also might raise the possibility that the within-person, state level covariation of approach/avoidance goals and extraverted/neurotic states is one explanation for the between-person associations between these constructs (Elliot & Thrash, 2002). Indeed, such trait-state isomorphism (Fleeson, 2001) has already been observed for extraversion and positive affect (Wilt et al., 2012; Ching et al., 2014). Extending the within-person mediation model that was tested in this paper to include trait-level constructs represents an important line of future inquiry.

Limitations

Although we specified our hypotheses as directional, we cannot make strong claims for causality or direction because we examined only cross-sectional associations between states. However, there is experimental evidence suggesting causal links from personality states to affect (Fleeson et al., 2002; McNiel & Fleeson, 2006; McNiel et al., 2010; Smillie, Cooper, Wilt, & Revelle, 2012; Smillie et al., 2015; Zelenski et al., 2013) well as from velocity to affect (Lawrence et al., 2002). Therefore, we believe that the hypothesized directionality in our models seems highly plausible. Nevertheless, future research should employ experimental methods and longitudinal designs to further examine directionality. Such research may benefit from a specific emphasis on comparing the model presented in this paper to a reverse model in which affect leads to velocity which in turn predicts personality states. This model was not examined in the current project as (to our knowledge) no prior theory nor empirical research has considered affect as an antecedent of velocity.

Another set of limitations is related to measurement. Although some of our measures achieved relatively low internal consistencies due mainly to a low number of items rather

than low correlations between items (and some of our measures included only one item and so internal consistencies could not be estimated), it would be beneficial to develop more internally consistent measures in future studies. Yet, it does not appear that lack of internal consistency impaired our ability to detect effects – indeed, our measures of state extraversion and state neuroticism were less internally consistent in Study 2 and had higher relations to velocity and affect in that study. Though our measure of approach-avoidance goals was used in previous research (Heller et al., 2007), it was also limited by relying on a single, forced-choice between approach and avoidance. A measure that assess approach and avoidance goal striving separately and as continuous variables might reflect those constructs more accurately (Elliot & Thrash, 2002).

Conclusion

Our goal in these studies was to examine dynamic mediation models explaining the relations between personality states and affective states. Specifically, we hypothesized that higher velocity toward goals might in part mediate the association between state extraversion and state positive affect, and we hypothesized that lower velocity toward goals might in part mediate the association between state neuroticism and state negative affect. We first tested and found support for these ideas in an ESM study in a natural setting, and we replicated these models and extended them (by including the approach-avoidance goal construct) in a second ESM study. These findings provide direct support for under-researched premises of control theories of self-regulation (e.g., Carver & Scheier, 1990 e.g., Carver & Scheier, 1998), add to the understanding of the relations between personality states and affective states (McNiel & Fleeson, 2002; Lischetzke et al., 2012; Smillie et al., 2015), and represent an example of the emerging trend in personality research (e.g., Wilt et al., 2011) of considering the dynamic relations between multiple kinds of psychological states.

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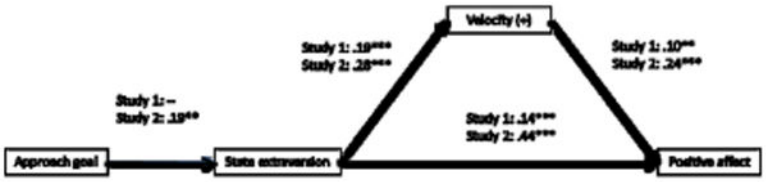

Figure 1.

Mediation model specifying that the relation between state extraversion and state positive affect is mediated through increased velocity toward goals. This figure shows the direct effects from mediation models specifying the relations between approach goals, state extraversion, velocity (+ = positively scored), and state positive affect. Numbers are unstandardized regression coefficients. ** = $p < .01$; *** = $p < .001$

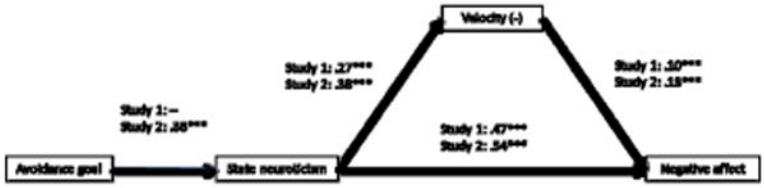

Figure 2.

Mediation model specifying that the relation between state neuroticism and state negative affect is mediated through decreased velocity toward goals. This figure shows the direct effects from mediation models specifying the relations between avoidance goals, state neuroticism, velocity (- = negatively scored), and state negative affect. Numbers are unstandardized regression coefficients. *** = $p < .001$

Table 1

Measures of Variables in Studies 1 and 2

Variable	Study 1 Measure	Study 2 Measure
State extraversion	bold, quiet (r), talkative	assertive, withdrawn (r), unrestrained
State neuroticism	touchy, temperamental, insecure	steady (r), anxious, emotional
Perceived velocity toward goal	I was moving quickly toward the goal, My progress toward the goal was slow (r), I was doing better than I expected at the goal	slower than expected – faster than expected
Perceived goal importance	The goal was important to me, The goal did not matter much to me	unimportant – very important
Perceived goal proximity	I almost achieved (or achieved) the goal, I was very far away from the goal (r)	far away or gave up – extremely close or achieved
Approach/avoidance goal content	--	pursuing a positive outcome / avoiding a negative outcome
State positive affect	alert, happy, attentive, strong	happy, cheerful, pleased
State negative affect	irritable, intense, upset	grouchy, irritable, gloomy

Note. Items measuring constructs included in Studies 1 and 2. Distinct items (adjectives, phrases, sentences) are separated by commas. Anchors for items that were measured on bipolar scales are separated by a dash "–". The approach/avoidance measure was a forced choice between responses separated by a slash "/". Approach/avoidance goal content was not assessed in Study 1.

Table 2

Descriptive Statistics

	M		Within-person *SD*		Within-person α/ω>		1-*ICC1*	
	Study 1	**Study 2**	**Study 1**	**Study 2**	**Study 1**	**Study 2**	**Study 1**	**Study 2**
State extraversion	2.65	3.36	1.01	0.74	.60/.75	.44/.52	.79	.66
State neuroticism	1.79	2.62	0.66	0.66	.54/.56	.39/.40	.61	.54
Approach/avoidance	--	1.16	--	0.32	--	--	--	.86
Velocity	3.60	3.90	0.98	1.08	.78/.80	--	.69	.80
Goal importance	4.73	4.21	1.03	1.22	.80/--	--	.72	.80
Goal proximity	3.32	4.26	0.84	1.13	.55/--	--	.65	.80
Positive affect	3.27	3.86	0.75	0.90	.62/.67	.83/.83	.55	.66
Negative affect	1.94	1.84	0.72	0.76	.53/.54	.83/.79	.63	.68

Note. M = average item mean for the typical individual. Approach/avoidance was rated on a scale from 1 to 2 (with 1 indicating approach), and all other states were rated on scales from 1 to 6. The *ICC1* was subtracted from 1 to show the proportion of total variance attributable to within-person variance.

Table 3

Results from Bivariate Multilevel Models

		Study 1					Study 2				
Predictor	**Outcome**	***b***	***95% CI$_b$***	***p-value***	***SD***	***95% CI$_{sd}$***	***b***	***95% CI$_b$***	***p-value***	***SD***	***95% CI$_{sd}$***
Approach	Extraversion	--	--	--			.21	[.07, .36]	.005	.35	[.23, .53]
Avoidance	Neuroticism	--	--	--			.42	[.25, .48]	< .001	.43	[.31, .59]
Extraversion	Velocity	.13	[.06, .21]	< .001	.11	[.06, .20]	.26	[.18, .35]	< .001	.19	[.12, .30]
Neuroticism	Velocity	-.33	[-.44, -.23]	< .001	.35	[.17, .36]	-.38	[-.43, -.32]	< .001	.22	[.15, .33]
Velocity	PA	.14	[.08, .20]	< .001	.20	[.14, .28]	.26	[.19, .34]	< .001	.17	[.12, .23]
Velocity	NA	-.18	[-.25, -.11]	< .001	.20	[.15, .27]	-.21	[-.27, -.15]	< .001	.17	[.13, .22]
Extraversion	PA	.14	[.08, .20]	< .001	.16	[.11, .22]	.52	[.43, .62]	< .001	.25	[.18, .34]
Neuroticism	NA	.53	[.42, .64]	< .001	.32	[.24, .43]	.53	[.43, .63]	< .001	.29	[.22, .39]

Note. Results from the bivariate MLMs. Predictors were group-mean centered around the individual's mean. Variables included in the models were approach/avoidance goals (Approach/Avoidance), state extraversion (Extraversion), state neuroticism (Neuroticism), velocity toward goals (Velocity), state positive affect (PA), and state negative affect (NA). "*b*" = unstandardized regression coefficient. "*SD*" = random effect.

Table 4

Results from the Multilevel Mediation Model Relating State Extraversion, State Positive Affect via Velocity

	Study 1			Study 2		
Path	***b***	***95% CI***	***p-value***	***b***	***95% CI***	***p-value***
Direct effects						
Extraversion ON Approach	--	--	--	.19	[.05, .33]	.01
Velocity (+) ON Extraversion	.19	[.13, .24]	< .001	.28	[.20, .35]	< .001
PA ON Velocity (+)	.10	[.03, .17]	.004	.24	[.18, .30]	< .001
PA ON Extraversion	.14	[.07, .20]	< .001	.44	[.33, .54]	< .001
Indirect effect						
Extraversion➔Velocity(+)➔PA	.02	[.01, .03]	.01	.07	[.04, .09]	< .001
Total effect						
Extraversion➔PA	.16	[.09, .22]	< .001	.50	[.40, .61]	< .001

Note. Results from the mediation models specifying the relations between approach goals (Approach), state extraversion (Extraversion), velocity (+ = positively scored), and state positive affect (PA). "*b*" = unstandardized regression coefficient.

Table 5

Results from the Multilevel Mediation Model Relating State Neuroticism to State Negative Affect via Velocity

	Study 1			Study 2		
Path	***b***	***95% CI***	***p-value***	***b***	***95% CI***	***p-value***
Direct effects						
Neuroticism ON Avoidance	--	--	--	.38	[.20, .56]	< .001
Velocity (-) ON Neuroticism	.27	[.17, .38]	< .001	.38	[.29, .47]	< .001
NA ON Velocity (-)	.10	[.05, .14]	< .001	.13	[.08, .18]	< .001
NA ON Neuroticism	.47	[.39, .55]	< .001	.54	[.43, .65]	< .001
Indirect effect						
Neuroticism➔Velocity(-)➔NA	.13	[.07, .19]	< .001	.20	[.13, .27]	< .001
Total effect						
Neuroticism➔NA	.60	[.47, .73]	< .001	.74	[.57, .91]	< .001

Note. Results from the mediation models specifying the relations between avoidance goals (Avoidance), state neuroticism (Neuroticism), velocity (- = negatively scored), and state negative affect (NA). "*b*" = unstandardized regression coefficient. Velocity was negatively scored to increase interpretability of the indirect effect.